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ABSTRACT

This ERIC Digest discusses the many ways that science and mathematics teachers can lead and help develop leadership in their schools and departments. The digest provides many suggestions about how teachers can lead along with ideas concerning the development of leadership roles. Resources for cultivating leadership are also provided. (Contains 14 references.) (MVL)

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Cultivating Leadership Among Science And Mathematics Teachers

David L. Haury

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DIGEST
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Clearinghouse for Science, Mathematics, and Environmental Education

The 20th century was a remarkable era for science and technology, a time when humans broke the bonds of gravity to visit the moon, broke the bonds of atoms to unleash the fundamental forces of nature, and broke the bonds of time to communicate and share information worldwide within an instant. Despite such progress, the century ended with concerns expressed about what Americans should know and be able to do in a world shaped by science and technology (Rutherford & Ahlgren, 1990). A vision of what seemed desirable led to the development of national standards in science and mathematics education (National Research Council, 1996; National Council of Teachers of Mathematics, 2000), and waves of systemic reform swept through schools (Webb, 1999).

As we enter the 21st century, we wonder who will provide the instructional leadership to bring substance to our vision of literacy in science and mathematics. Though some hold designated roles as school leaders, we have known for some time that school principals are generally not perceived as instructional leaders, and that instructional leadership in the most effective schools is a shared responsibility (Pellicer, Anderson, Keefe, Kelley, & McCleary, 1990). Lambert (1998) said, in fact, that we often make the mistake of viewing leadership as being synonymous with assigned or formal roles. More recently, it has been acknowledged that "teachers are the best and most abundant source of leadership…for our schools" (Pellicer & Anderson, 2001) and that "if schools are to be restructured successfully, teachers must assume a variety of important instructional leadership responsibilities" (p. 14).

How Teachers Lead

There have long been formal leadership roles for teachers as department chairs, team leaders, and a variety of other positions, but titles are less important than actually functioning as effective change-agents. Teachers participating in a National Teacher Forum (Paulu, 1998) characterized teachers as exhibiting leadership by:

1. *Participating in professional teacher organizations*, including holding positions of influence.
2. *Taking part in school decisions*, including working on teams with administrators to plan school improvements.
3. *Defining what students need to know and be able to do*, including developing standards for curriculum and assessments.
4. *Sharing ideas with colleagues*, including leading professional development programs for colleagues.
5. *Being a mentor to new teachers.*
6. *Helping to make personnel decisions*, including the hiring of new teachers and administrators
7. *Improving facilities and technology.*
8. *Working with* parents, including the development of better links between schools and homes.
9. *Creating partnerships with the community*, including working with communities to improve the schools.
10. *Creating partnerships with business and organizations, taking* the lead in forming partnerships.
11. *Creating partnerships with colleges and universities to prepare future teachers.*
12. *Becoming leaders in the community.*
13. *Becoming politically involved*, including running forelected to offices, testifying before state legislatures, working on political campaigns, or serving on education advisory boards that report to the governor or the state department of education.
14. *Leading efforts to make teachers more visible and communicate positive information.*

This is a rather long list of specific ways that teachers exhibit leadership, but is there a more succinct way of characterizing the essential nature of leadership in education? After interviewing 43 educational leaders, Goldberg (2001) reported five commonalities that stood out among those he interviewed:

1. A bedrock belief that what they are doing is good and important.
2. The courage to swim upstream, persevering in their beliefs in the face of resistance or criticism.
3. A social conscience, particularly on issues of racism and poverty.
4. A seriousness of purpose, holding high standards and devoting years of sustained involvement in their causes.
5. Situational mastery, the happy marriage of personal skills and accomplishment.

This last characteristic is one that makes it impossible to specify a generic set of skills or understandings that one needs to become a leader in education. Leadership in education is very situational, and those who would lead must develop their leadership style to match the context of their sphere of influence.

Bringing Focus to Leadership Development

There have been a variety of formal approaches to cultivating leadership among science and mathematics teachers (Nesbit, Wallace, Pugalee, Miller, & Dibiase, 2001), and no one approach has emerged as the most effective in all situations. Indeed, in a study of 15 two-year lead teacher professional development programs in science and mathematics, six identifiable leadership models were noted (Wallace, Nesbit, & Miller, 1999). Examples of teacher leaders were found to span the spectrum from classroom teachers who demonstrate and model new techniques within their own classrooms to highly proactive "change agents" who challenge, inspire, and motivate colleagues to initiate school wide change. Is there a way of bringing focus to the identification and cultivation of teacher leaders in science and mathematics?

In their study of 354 teacher leaders participating in 15 two-year professional development programs, Nesbit, DiBiase, Miller, and Wallace (2001) analyzed evaluation reports and conducted interviews. They found three broad categories of factors to be most influential in supporting the development of leadership roles:

1. Factors related to knowledge of content and pedagogy, including learning in-depth content through hands-on activities, learning instructional strategies, and learning about curriculum resources.
2. Factors related to the modes of professional development, from receiving curriculum materials to observing teaching and leadership techniques, receiving ongoing support from a professional development staff, and analyzing a school's strengths and weaknesses.
3. Factors related to the development of leadership skills,

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both through learning about leadership skills (*i.e.* presentation skills, team-building skills) and concepts (i.e. the change process, adult development), and through planning and practicing leadership skills. This could include working with other teacher leaders on instruction, resolving leadership challenges, becoming familiar with school improvement plans, or role playing

The authors noted that the first two broad categories are typically addressed in professional development programs, and their importance is well supported by the literature in the field. The unique contribution of this study is the clear identification of explicit development of leadership skills as being a key component in cultivating teacher leaders in science and mathematics. There is little research identifying the essential elements of this component, however, and it is often neglected in teacher leader development programs.

In stating some of the core expectations of teacher leaders, Sherrill (1999, p.60) identified dimensions for leadership skill development. Teacher leaders are expected to:

- Demonstrate exemplary classroom instruction and knowledge of effective strategies for teaching and learning.
- Understand theories of adult development.
- Demonstrate knowledge of clinical supervision models and procedures that promote effective classroom practices.
- Cultivate desired dispositions among teachers.
- Guide colleagues through reflective and inquiry-oriented techniques.
- Possess research-based knowledge about teaching and learning.

DiRanna and Loucks-Horsley (2001) also stated that "teacher leaders must develop expertise in organization design, change theory, adult learning, management skills, decision making, public relations, and handholding." To these basic skills, Pugalee, Frykholm, and Shaka (2001) would add the need for teacher leaders to embrace issues of equity and assist in the development of technology plans for schools and districts. Following are some resources that will help professional development teams cultivate the growth of teacher leaders.

Resources for Cultivating Leadership

Miller, B., Moon, J., & Elko, S. (2000). *Teacher leadership in mathematics and science: Casebook and facilitator's guide*. Portsmouth, NH: Heinemann. [ED 446 988]

This book offers an alternative strategy to the one-time workshops and institutes typically used for cultivating leadership skills: the case method long used in preparing doctors and lawyers. Cases are used to illustrate and provoke discussions of many challenges and dilemmas faced by teacher leaders, whether novices or highly experienced. Along with the cases, there are guidelines for facilitating rich discussions.

Professional and Leadership Development
http://www.nsba.org/sbot/toolkit/P&LDev.html

Though designed for school board members, this directory of online resources includes practical guidelines of identifying and cultivating leadership in educational settings. This resources ahs been developed by project of the National School Boards Foundation with a grant from the National Science Foundation.

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